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(54) **AXIAL COMPRESSION DEVICE**
AXIALKOMPRESSIONSVORRICHTUNG
DISPOSITIF DE COMPRESSION AXIALE

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Description

Background of the Invention

This invention relates to devices for the fixation of fractured bones and in particular to a device for the fixation of fractures involving long bones, such as subtrochanteric and intertrochanteric fractures of the femur.

The successful fixation of any fractured long bone is generally dependent upon two basic considerations. First, the fracture site should be rigidly maintained in compression to stimulate bone repair; and second, shear, rotational and angular stresses at the fracture site should be minimized (and if possible eliminated) as such stresses inhibit bone union. In fractures involving the proximal aspect of the femur, for example, these considerations are particularly important due to the considerable magnitude and complex distribution of the forces to which this region is subjected. (Loads up to four times body weight may be transmitted through this region during the gait cycle.)

Heretofore, the fixation of fractures of the proximal femur has typically been attempted by the insertion of a hip compression screw, usually comprising a lag screw to be secured in the femoral head, a compression plate cooperable with the lag screw to be secured to the femoral shaft and a compression screw for attaching the compression plate to the lag screw and applying a compressive force therebetween. Such devices have also been more generally used for the fixation of fractures in which one major fragment is mostly cancellous and the other fragment is primarily cortical (e.g., supracondylar fractures of the distal femur).

Although prior hip compression devices are effective for the fixation of certain types of fracture configurations involving the proximal femur (more specifically, certain intertrochanteric fracture configurations), there are many fracture configurations for which these devices perform poorly or are ineffective. For example, in the case of subtrochanteric fractures of the proximal femur (as well fractures in other regions such as supracondylar fractures of the distal femur), prior hip compression devices can allow significant shear, rotational and angular forces to occur while failing to provide the desired compressive forces at the fracture site. In practice, such characteristics may lead to a loss of reduction, non-union or malunion of the fractured bone and even breakage of the device subsequent to insertion.

According to DE-A-918 531, a fracture g is bridged by a cover plate 6 (slide member) placed on the surface of bone fragment a. A covering plate (retaining member) 8 is placed over cover plate 6 and is secured to bone fragmnet a. The covering plate 8 is in direct face-to-face contact with the fragment a only at a base end of the covering plate, the cover plate 6 being interposed between the plate 8 and the bone surface over the major portion of the length of plate 8. The covering plate 8 is secured to bone fragment a by a screw 10 at the plate base end and by screws 9 thereabove, which screws 9 also pass through slots 7 in the cover plate 6. The cover plate 6 and covering plate 8 are drawn in opposite directions by a draw spring 14, which applies a predetermined compressive force across fracture g.

In order to allow reciprocal shifting (pressing together) of the bone fragments across the fracture site g, the cover plate 6 is slidable between the surface of bone fragment a and the covering plate 8. This requires that screws 9 be left sufficiently loose that the cover plate 6 is, in turn, loosely disposed between the covering plate 8 and the bone fragment a.

The DE '531 device is subject to a number of very significant practical disadvantages. Perhaps most significantly, because of the inherent "slop" (looseness) associated with the loosely secured screws 9 and resulting loose coupling of the plates 6 and 8, the DE '531 device cannot achieve rigid fixation of both the proximal and distal bone fragments. As a result, shear, torsion, and roational forces and displacements could occur at the fracture site g. As will be appreciated from the present specification, such forces and displacements are highly undesirable, because they impair the healing process. See, for example, pages 1-2.

As another disadvantage, the applicability of the DE '531 device would appear to be severely limited by the length and positions of the slots 7. Further still, at least in the embodiment of Fig. 1, because the spring 14 can lengthen as well as shorten, the DE '531 device could theoretically become uncoupled and piston as the patient walks. The use of a draw spring is also disadvantageous in that the surgeon cannot precisely adjust the compression applied to the fracture site. Moreover the surface of the bone fragment a is at the risk of being damaged when the cover plate is travelling along the bone fragment.

US-A-3,900,025 discloses a device for the fixation of two longitudinally disposed bone fragments. This structure is disadvantageous in that it involves a bulky and complex arrangement of plates which are interconnected, for example, by an intermediate rack-and-pinion and ratcheting mechanism. Moreover, the configuration is limiting, being at best poorly suited for application to the proximal femur.

The present invention overcomes these deficiencies and other disadvantages of the prior art.

Summary of the Invention

In accordance with the present invention, an axial compression device is provided whereby longitudinally adjacent segments of a fractured long bone may be placed and maintained in rigid axial compression and whereby shear, rotational and angular forces at the fracture site are minimized.

The scope-determining aspects of the invention are defined in the appended independent claim.

The features and advantages of the invention will be further understood from the following description of the

preferred embodiment taken in connection with the accompanying drawing.

Brief Description of the Drawing

Fig. 1 is an elevation view shown partly in section of an axial compression device according to the invention applied to the proximal aspect of a right femur, and

Fig. 2 is an exploded perspective view of the axial compression device of Fig. 1.

Description of the Preferred Embodiment

Figs. 1 and 2 illustrate a preferred axial compression device in accordance with the present invention. For the purposes of example only, the device is shown particularly adapted for the fixation of a fractured femur wherein both a subtrochanteric fracture and an intertrochanteric fracture are present. Fig. 1 depicts a right femur in such condition. More specifically, the femur in Fig. 1 includes three bone fragments: a fragment denoted by the reference letter A, a fragment transverse to fragment A and denoted by the reference letter B, and another fragment disposed longitudinally of fragment A and denoted by reference letter C. As indicated in the drawing, the intertrochanteric fracture appears between bone fragment A (which includes the greater and lesser trochanters) and bone fragment B (which includes the femoral head). The subtrochanteric fracture appears between bone fragment A and bone fragment C (which includes the upper portion of the femoral shaft). It is to be understood, of course, that while the invention will hereinafter be explained in connection with the multiply fractured femur just described, an axial compression device according to the invention may (as will be apparent from the ensuing discussion) be employed for the fixation of a variety of fracture configurations such as a subtrochanteric fracture alone or a supracondylar fracture of the distal femur.

Referring now to Fig. 2, it will be seen that the illustrated embodiment of the invention comprises shaft means such as a lag screw 10, slide means such as an angled slide member 20 and retaining means such as a barrelled side plate (retaining member) 40. These components are preferably made from a substantially rigid material of low biologic reactivity such as stainless steel, carbon fiber or one of the various cobalt alloys used for surgical purposes (as are the remaining components of the device to be discussed later). The lag screw 10 includes a cylindrical shaft portion 12 and is adapted to be secured to a bone fragment, in this case fragment B, in the standard manner by means of a threaded head portion 14. It will be appreciated that when the lag screw is threaded into position in bone fragment B, the lag screw shaft 12 will be secure within bone fragment A. For reasons which will soon be apparent, the lag screw shaft 12 is provided with a threaded axial bore 16 and a longitudinal groove or keyway 18a on its outer surface.

With continued reference to Fig. 2, it will further be observed that the angled slide member 20 comprises a first leg 22 and a second leg 24 (both of substantially cylindrical cross section in the form shown) disposed at an angle relative to each other. The particular orientation of legs 22 and 24 will naturally vary depending upon the particular fracture configuration to be treated but will typically be an angle in the range of 90°-150°. The first leg 22 of the angled slide member has an axial bore 26 through its length which is adapted at one end (the end opposite the vertex of slide member 20) to receive the lag screw shaft 12. Leg 22 may thus be inserted into the femur proximally of the subtrochanteric fracture for engagement with the lag screw shaft 12 as shown in Fig. 1. To ensure proper alignment of the lag screw shaft 12 and bore 26, the bore includes an inwardly projecting key 18b for cooperation with the previously mentioned keyway 18a on the outer surface of lag screw shaft 12. The opposite end of bore 26 is adapted to receive a compression screw 60. Preferably, bore 26 also includes an intermediate portion 28 of reduced diameter which forms a shoulder 30 within the bore which serves as a stop for the head of compression screw 60. The shaft of compression screw 60 is adapted to pas through the reduced diameter portion 28 for engagement with the threaded axial bore 16 in the lag screw shaft 12. It will therefore be appreciated that by threading the compression screw 60 into the threaded axial bore 16, the lag screw 10 and the first leg 22 of the angled slide member may be drawn tightly together to apply a compressive force between the bone fragments A and B (i.e., across the intertrochanteric fracture surface).

To prevent any shifting of the lag screw shaft 12 within leg 22 of the angled slide member once compression screw 60 has been threaded in place, and more particularly, to prevent lateral displacement of the intertrochanteric fracture fragments A and B on the subtrochanteric fragment C with weight bearing, locking means such as a locking screw 62 is inserted rearward of screw 60 in bore 26. As shown in Fig. 1, the bore 26 is adapted to threadably receive locking screw 62 rearward of compression screw 60 so that the locking screw 62 may be threaded into firm abutment against the head of the screw 60. Of course, any of a variety of locking elements (such as a keyed metal disk which is rotated into a locked position within bore 26) could be used in place of locking means for the described purpose.

To complete the fixation of the fractured bone shown in Fig. 1, the barrelled side plate 40 and the second leg 24 of the angled slide member are coupled in a manner now to be described. In accordance with the preferred form of the invention shown, barrelled side plate 40 is a retaining member of substantially cylindrical configuration which is adapted to be attached to bone fragment C by means of fixation screws 64. Fixation screws 64 thread into bone segment C through holes such as 50 in projecting flanges 48 on the body of the barrelled side plate 40.

Similarly to the first leg 22 of the angled slide member, the barrelled side plate 40 includes an axial bore 42 through its length. The bore 42 is adapted at one of its ends (the upper end as shown in the drawing) to slidably (or, more specifically, telescopically) receive the second leg 24 of the angled slide member. Bore 42 is further adapted at its opposite end to receive an additional compression screw 66. Appropriate alignment between the second leg 24 of the angled slide member and the barrelled side plate 40 is ensured by a key 32b which projects into bore 42 for cooperation with a longitudinal groove or keyway 32a on the outer surface of the second leg 24. In practice, the key 32b and keyway 32a may be arranged with different rotational alignments to permit the application of varying degrees of torsion to longitudinally adjacent bone fragments such as fragments A and B.

Preferably, as was the case with bore 26, the bore 42 in barrelled side plate 40 includes an intermediate portion 44 of reduced diameter that forms a shoulder 46 within the bore which acts as a stop for the head of compression screw 66 as is shown in Fig. 1. The shaft of compression screw 66 is adapted to pass through the reduced diameter portion 44 for engagement with a threaded axial bore 34 in the second leg 24 of the angled slide member (see Fig. 1). Thus it will be apparent that by threading the compression screw 66 into the threaded axial bore 34, the second leg 24 of the angled slide member and the barrelled side plate 40 will be drawn tightly together. This action, of course, serves to apply a compressive force between the bone segments A and C (i.e., across the subtrochanteric fracture site). It should be noted that in the case of compression screw 66, it is preferable not to provide a locking screw or the like as was done in connection with compression screw 60. This permits rearward movement of the compression screw 66 within bore 42 so that additional dynamic compressive loading may occur at the subtrochanteric fracture site with weight bearing, thereby further enhancing the healing process.

From the preceding discussion it will be appreciated that by virtue of the invention, rigid fixation of the multiply fractured femur in Fig. 1 is achieved in conformity with the basic considerations set forth at the outset hereof. More specifically, the cooperable assembly of the slide member 20 and the side plate 40 provide the desired compressive force at the subtrochanteric fracture site while shear, rotational and angular stresses at the fracture site are substantially eliminated as a result of the general geometry of the axial compression device. A similar effect is achieved at the intertrochanteric fracture site by the cooperative relationship of the lag screw 10 and the slide member 20.

While a preferred form of the invention has been shown and described, it will be appreciated by those skilled in the art that numerous modifications may be made according to the principles of the invention, the scope of which is defined in the appended claims. For example, it may be desirable in various situations to use components of different configurations from those shown (i.e., components of non-cylindrical cross section). In addition, it may be beneficial in some situations to provide additional fixation means whereby the slide member may be attached directly to one of the fractured bone fragments. It may further be desirable for certain applications to include a ratcheting mechanism for the slide member and compression slide to prevent disengagement thereof.

Claims

1. A device allowing axial compression for the fixation of a fractured bone having a first bone fragment (A), a second bone fragment (B) disposed transverse to the first bone fragment and a third bone fragment (C) disposed longitudinally of the first bone fragment, the device comprising first means (10) adapted to be inserted in and secured to said second bone fragment (B), second means including an angled slide member (20) having two legs (22,24), the first leg (22) being cooperable with said first means (10) and being adapted to receive a compression means (60) for compressing said first and second bone fragments, and a retaining member (40) adapted to be secured to said third bone fragment (C), **characterized** in that the retaining member (40) has an axial bore (42) extending therethrough which is adapted at one of its ends to receive the second leg (24) of said angled slide member (20) for aligning the same, that the axial bore (42) forms a path along which said second leg (24) of said slide member (20) travels for applying a compressive force between said first and third bone fragments, and that the retaining member (40) has on both sides of said path projecting flanges (48) including holes (50) to be passed by screws (64) threadable into the third bone segment (C) to rigidly fix the retaining member to the third bone segment (C).

2. A device as claimed in claim 1, **characterized** in that said retaining member (40) and the second leg (24) of said angled slide member (20) have cooperable key and keyway means (32a,32b) for aligning the same.

3. A device as claimed in claim 1 or 2, **characterized** in that said axial bore (42) and said angled slide member (20) have non-cylindrical cross sections.

4. An axial compression device as recited in any of claims 1-3, **characterized** in that said retaining member (40) is constructed, over a major portion of its length at which said leg of said slide member is received, for direct face-to-face contact with said third bone fragment.

5. A device as claimed in any of claims 1-4, **characterized** in that said first means (10) comprises a lag screw (10) having a shaft (12) with a threaded axial bore (16) therein and that said first leg (22) of the slide member (20) has an axial bore (26) extending therethrough which is adapted at one of its ends to receive the shaft (12) of said lag screw (10) and at its opposite end to receive a compression screw (60) adapted to threadably engage the threaded axial bore (16) in the shaft (12) of said lag screw (10).

6. A device as claimed in claims 1-5, **characterized** in that the axial bore (26) extending through the first leg (22) of said angled slide member (20) has an intermediate portion (28) of reduced diameter which forms a shoulder within that bore (26), and that said compression screw (60) has a shaft portion adapted to pass through said intermediate portion (28) of reduced diameter for engagement with the threaded axial bore (16) in the shaft of said lag screw (12) and a head portion adapted to abut the shoulder formed by said intermediate portion (28) of reduced diameter.

7. A device as claimed in claim 6, **characterized** in that the axial bore (26) extending through the first leg (22) of said angled slide member (20) is further adapted at its said opposite end to receive locking means (62) for preventing shifting of said additional compression screw.

8. An axial compression device as claimed in claim 7, **characterized** in that said locking means (62) comprises an additional screw (62) adapted to threadably engage the axial bore (26) extending through the first leg (22) of said angled slide member (20) rearwardly of said compression screw (60).

9. A device as claimed in claim 5, **characterized** in that the axial bore (26) extending through the first leg (22) of said angled slide member (20) and the shaft (12) of said lag screw (10) are provided with cooperable key and keyway means (18a,18b) for aligning the same.

10. A device as claimed in any of claims 1-9, **characterized** in that said retaining member (40) is configured toward an end opposite said one end receiving said second leg (24) of said slide member (20) to receive a compression screw (66) threadably adjustably engageable with said second leg (24) in an axial direction of said leg for adjustably setting said first and third bone fragments (A,C) into rigid axial compression, and that said retaining member has a stop (46) for stopping a head of said compression screw.

11. A device as claimed in claim 10, **characterized** in that the second leg (24) of said angled slide member (20) has a threaded axial bore (34) therein for threadably engaging the compression screw (66) engageable with said second leg (24), and that said bore (42) of the retaining member (40) is adapted at one of its ends to telescopically receive the second leg (24) of said angled slide member (20) and at its opposite end to receive said compression screw (66) engageable with said second leg (24).

12. A device as claimed in claim 11, **characterized** in that said bore (42) of the retaining member (40) has a portion (44) of reduced cross-dimension which forms said stop (46), and that said compression screw (66) engageable with said second leg (24) has a shaft portion constructed to pass through said portion (44) of reduced cross-dimension for engagement with the threaded axial bore (34) in the second leg (24) of said angled slide member and a head portion adapted to abut the stop (46) formed by said portion (44) of reduced cross-dimension.

Patentansprüche

1. Vorrichtung, mit der ein axiales Zusammenziehen für eine Fixierung eines gebrochenen Knochens ermöglicht wird, der ein erstes Knochenteil (A), ein zweites Knochenteil (B), das quer zum ersten Knochenteil ausgerichtet ist, und ein drittes Knochenteil (C), das längs zum ersten Knochenteil ausgerichtet ist, aufweist, wobei die Vorrichtung ein erstes Mittel (10) umfaßt, das zum Einsetzen in und Festsetzen an dem zweiten Knochenteil (B) dient, und ein zweites Mittel, das ein gewinkeltes, zwei Schenkel (22, 24) aufweisendes Verschiebungsteil (20) aufweist, und wobei der erste Schenkel (22) mit dem ersten Mittel (10) zusammenwirkend ausgebildet ist und ein Zusammenziehmittel (60) zum Zusammenziehen des ersten und des zweiten Knochenteiles sowie ein Halteteil (40), das am dritten Knochenteil (C) befestigt ist, aufweist, dadurch gekennzeichnet, daß das Halteteil (40) eine durch dieses hindurchgehende axiale Bohrung (42) aufweist, welche an ihrem einen Ende zur Aufnahme des zweiten Schenkels (24) des gewinkelten Verschiebungsteils (20) und zu dessen Ausrichtung dient, daß die axiale Bohrung (42) eine Führungsbahn bildet, entlang derer sich der zweite Schenkel (24) des Verschiebungsteils (20) bewegt, um eine Kompressionskraft zwischen dem ersten und dem dritten Knochenteil auszuüben, und daß das Halteteil (40) zu beiden Seiten der Führungsbahn vorstehende Flansche (48) aufweist, die Löcher (50) zum Durchgang von Schrauben (64) aufweisen, die in das dritte Knochenteil (C) einschraubbar sind, um das Halteteil (40) am dritten Knochenteil (C) stabil zu befestigen.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß das Halteteil (40) und der zweite Schenkel (24) des gewinkelten Verschiebungsteils (20) miteinanderzusammenwirkende Vorsprungs-

und Vorsprungsnutmittel (32a, 32b) zu ihrer Ausrichtung aufweisen.

3. Vorrichtung nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die axiale Bohrung (42) und das gewinkelte Verschiebungsteil (20) nicht-zylindrische Querschnitte aufweisen.

4. Vorrichtung nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß das Halteteil (40) über einen größeren Teil seiner Länge, über die der Schenkel des Verschiebungsteils aufgenommen wird, derart ausgebildet ist, daß es in direktem gegenüberliegenden Kontakt mit dem dritten Knochenteil steht.

5. Vorrichtung nach einem dar Ansprüche 1 bis 4, dadurch gekennzeichnet, daß das erste Mittel (10) einen Verankerungsbolzen (10) mit einem Schaft (12) umfaßt, der eins mit einem Gewinde versehene Bohrung (16) aufweist, und daß der erste Schenkel (22) des Verschiebungsteils (20) eine durch diesen hindurchgehende axiale Bohrung (26) aufweist, die an ihrem einen Ende zur Aufnahme des Schaftes (12) des Verankerungsbolzens (10) und an ihrem anderen Ende zur Aufnahme einer Zusammenziehschraube (60) dient, die schraubend mit der axialen Gewindebohrung (16) des Schaftes (12) des Verankerungsbolzens (10) in Eingriff steht.

6. Vorrichtung nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß die sich durch den ersten Schenkel (22) des gewinkelten Verschiebungsteils (20) hindurchstreckende axiale Bohrung (26) ein mittleres Teil (28) mit verhindertem Durchmesser aufweist, das einen Vorsprung innerhalb der Bohrung (26) bildet, und daß die Zusammenziehschraube (60) ein Schaftteil aufweist, das durch das mittlere Teil (28) mit vermindertem Durchmesser zum Eingriff mit der axialen Gewindebohrung (16) im Schaft des Verankerungsbolzens (12) hindurchgeht, und ein Kopfteil zur Anlage an die Schulter, die durch das mittlere Teil (28) mit vermindertem Durchmesser gebildet wird.

7. Vorrichtung nach Anspruch 6, dadurch gekennzeichnet, daß die sich durch den ersten Schenkel (22) des gewinkelten Verschiebungsteils (20) hindurcherstreckende axiale Bohrung (26) an ihrem gegenüberliegenden Ende zur Aufnahme von Versiegelungsmitteln (62) zur Verhinderung einer Verschiebung der zusätzlichen Zusammenziehschraube dient.

8. Vorrichtung nach Anspruch 7, dadurch gekennzeichnet, daß die Versiegelungsmittel (62) eine zusätzliche Schraube (62) umfassen, die zum Gewindeeingriff in die axiale Bohrung (26) dient, die sich durch den ersten Schenkel (22) des gewinkelten Verschiebungsteils (20) hinter der Zusammenziehschraube (60) erstreckt.

9. Vorrichtung nach Anspruch 5, dadurch gekennzeichnet, daß die sich durch den ersten Schenkel (22) das gewinkelten Verschiebungsteils (20) hindurcherstreckende axiale Bohrung (26) und der Schaft (12) des Verankerungsbolzens (10) mit miteinander zusammenwirkenden Vorsprungs- und Vorsprungsnutmitteln (18a, 18b) versehen sind.

10. Vorrichtung nach einem der Ansprüche 1 bis 9, dadurch gekennzeichnet, daß das Kompressionsmittel (40) an einem Ende entgegengesetzt zu dem einen Ende, das den zweiten Schenkel (24) des Verschiebungsteils (20) aufnimmt, zur Aufnahme einer Zusammenziehschraube (66) ausgebildet ist, die schraubbar einstellbar in Eingriff mit dem zweiten Schenkel (24) in einer axialen Richtung des Schenkels bringbar ist, um das erste und das zweite Knochenteil (A, C) einstellbar in eine feste axiale Kompression zu bringen, und daß das Kompressionsmittel einen Anschlag (46) zur Anlage eines Kopfes der Zusammenziehschraube aufweist.

11. Vorrichtung nach Anspruch 10, dadurch gekennzeichnet, daß der zweite Schenkel (24) des abgewinkelten Verschiebungsteils (20) zum schraubenden Eingriff der Zusammenziehschraube (66), die mit dem zweiten Schenkel (4) in Eingriff bringbar ist, eine axiale Gewindebohrung (34) aufweist, und daß die Bohrung (42) des Kompressionsmittels (40) an einem ihrer Enden zur verschiebbaren Aufnahme des zweiten Schenkels (24) des abgewinkelten Verschiebungsteils (20) dient und an ihrem anderen Ende zur Aufnahme der Zusammenziehschraube (66), die mit dem zweiten Schenkel (24) in Eingriff bringbar ist.

12. Vorrichtung nach Anspruch 11, dadurch gekennzeichnet, daß die Bohrung (42) des Kompressionsmittels (40) ein Teil (44) mit verminderter Querschnittsabmessung aufweist, das einen Anschlag (46) bildet, und daß die mit dem zweiten Schenkel (24) in Eingriff bringbare Zusammenziehschraube (66) einen Schaftabschnitt aufweist, der zum Durchtritt durch das Teil (44) mit vermindertem Druckmesser zum Eingriff mit der axialen Gewindebohrung im zweiten Schenkel (24) des abgewinkelten Verschiebungsteils ausgebildet ist, sowie ein Kopfteil zur Anlage an den Anschlag (46), der durch das Teil (44) mit verminderter Querschnittabmessung gebildet wird.

Revendications

1. Dispositif permettant une compression axiale pour la fixation d'un os fracturé comportant un premier fragment d'os (A), un deuxième fragment d'os (B)

disposé transversalement au premier fragment d'os et un troisième fragment d'os (C) disposé longitudinalement au premier fragment d'os, le dispositif comprenant un premier moyen (10) adapté à être inséré dans ledit deuxième fragment d'os (B) et fixé à celui-ci, un second moyen comprenant un organe coulissant angulaire (20) comportant deux jambages (22, 24), le premier jambage (22) coopérant avec ledit premier moyen (10) et étant adapté à recevoir un moyen de compression (60) pour comprimer lesdits premier et deuxième fragments d'os, et un organe de retenue (40) adapté à être fixé audit troisième fragment d'os (C), caractérisé en ce que l'organe de retenue (40) comporte un alésage axial (42) le traversant qui est adapté à une de ses extrémités à recevoir le second jambage (24) dudit organe coulissant angulaire (20) pour aligner celui-ci, en ce que l'alésage axial (42) forme un passage le long duquel ledit second jambage (24) dudit organe coulissant angulaire (20) se déplace pour appliquer une force de compression entre lesdits premier et troisième fragments d'os, et en ce que l'organe de retenue (40) comporte sur les deux côtés dudit passage des oreilles en projection (48) comprenant des trous (50) dans lesquels passent des vis (64) pouvant être vissées dans le troisième fragment d'os (C) pour fixer solidement l'organe de retenue au troisième fragment d'os (C).

2. Dispositif selon la revendication 1, caractérisé en ce que ledit organe de retenue (40) et le second jambage (24) dudit organe coulissant angulaire (20) sont dotés d'une clavette et d'une rainure à clavette (32a, 32b) pour leur alignement.

3. Dispositif selon la revendication 1 ou 2, caractérisé en ce que ledit alésage axial (42) et ledit organe coulissant angulaire (20) ont une section transversale non cylindrique.

4. Dispositif selon l'une quelconque des revendications 1 à 3, caractérisé en ce que ledit organe de retenue (40) est construit, sur une majeure partie de sa longueur où ledit jambage dudit organe de retenue est reçu, pour un contact face contre face direct avec ledit troisième fragment d'os.

5. Dispositif selon l'une quelconque des revendications 1 à 4, caractérisé en ce que ledit premier moyen (10) comprend une vis à enveloppe (10) comportant un arbre (12) avec un alésage axial taraudé (16) en son sein et en ce que ledit premier jambage (22) de l'organe coulissant (20) comporte un alésage axial (26) le traversant qui est adapté à une de ses extrémités à recevoir l'arbre (12) de ladite vis à enveloppe (10) et à son extrémité opposée à recevoir une vis de compression (60) adaptée à engager par vissage l'alésage axial taraudé (16) dans l'arbre (12) de ladite vis à enveloppe (10).

6. Dispositif selon l'une quelconque des revendications 1 à 5, caractérisé en ce que l'alésage axial (26) traversant le premier jambage (22) dudit organe coulissant angulaire (20) comporte une portion intermédiaire (28) de diamètre réduit qui forme un épaulement au sein dudit alésage (26), et en ce que ladite vis de compression (60) comporte une portion d'arbre adaptée à passer dans ladite portion intermédiaire (28) de diamètre réduit pour engagement avec l'alésage axial taraudé (16) dans l'arbre de ladite vis à enveloppe (10) et une portion de tête adaptée à buter contre l'épaulement formé par ladite portion intermédiaire (28) de diamètre réduit.

7. Dispositif selon la revendication 6, caractérisé en ce que l'alésage axial (26) traversant le premier jambage (22) dudit organe coulissant angulaire (20) est en outre adapté à son extrémité opposée à recevoir un moyen de verrouillage (62) pour empêcher le déplacement de ladite vis de compression supplémentaire.

8. Dispositif selon la revendication 7, caractérisé en ce que ledit moyen de verrouillage (62) comprend une vis supplémentaire (62) adaptée à engager par vissage l'alésage axial (26) traversant le premier jambage (22) dudit organe coulissant angulaire (20) à l'arrière de ladite vis de compression (60).

9. Dispositif selon la revendication 5, caractérisé en ce que l'alésage axial (26) traversant le premier jambage (22) dudit organe coulissant angulaire (20) et l'arbre (12) de ladite vis à enveloppe (10) sont dotés d'une clavette et d'une rainure à clavette (18a, 18b) pour leur alignement.

10. Dispositif selon l'une quelconque des revendications 1 à 9, caractérisé en ce que ledit organe de retenue (40) est configuré vers une extrémité à l'opposé de ladite extrémité recevant ledit second jambage (24) dudit organe coulissant angulaire (20) pour recevoir une vis de compression (66) pouvant être engagée par vissage avec ledit second jambage (24) dans une direction axiale dudit jambage pour fixer de manière réglable lesdits premier et troisième fragments d'os (A, C) en compression axiale rigide, et en ce que ledit organe de retenue comporte un arrêt (46) pour arrêter la tête de la vis de compression.

11. Dispositif selon la revendication 10, caractérisé en ce que le le second jambage (24) dudit organe coulissant angulaire (20) comporte un alésage axial taraudé (34) en son sein pour engager par vissage la vis de compression (66) pouvant être engagée avec ledit second jambage (24), et en ce que ledit alésage (42) de l'organe de retenue (40) est adapté à une de ses extrémités à recevoir de manière télescopique le second jambage (24) dudit organe cou-

lissant angulaire (20) et à son extrémité opposée à recevoir ladite vis de compression (66) pouvant être engagée avec ledit second jambage (24).

12. Dispositif selon la revendication 11, caractérisé en ce que ledit alésage (42) de l'organe de retenue (40) comporte une portion (44) de diamètre réduit qui forme ledit arrêt (46), et en ce que ladite vis de compression (66) pouvant être engagée avec ledit second jambage (24) comporte une portion d'arbre conçue pour passer dans ladite portion (44) de diamètre réduit pour engagement avec l'alésage axial taraudé (34) dans le second jambage (24) dudit organe coulissant angulaire et une portion de tête adaptée à buter contre l'arrêt (46) formé par ladite portion (44) de diamètre réduit.

FIG. 2.

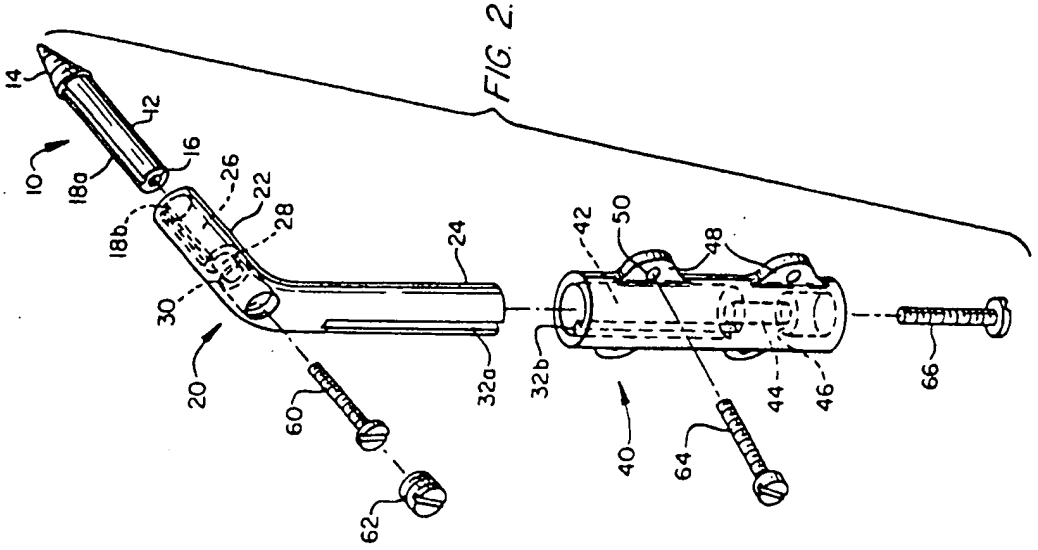
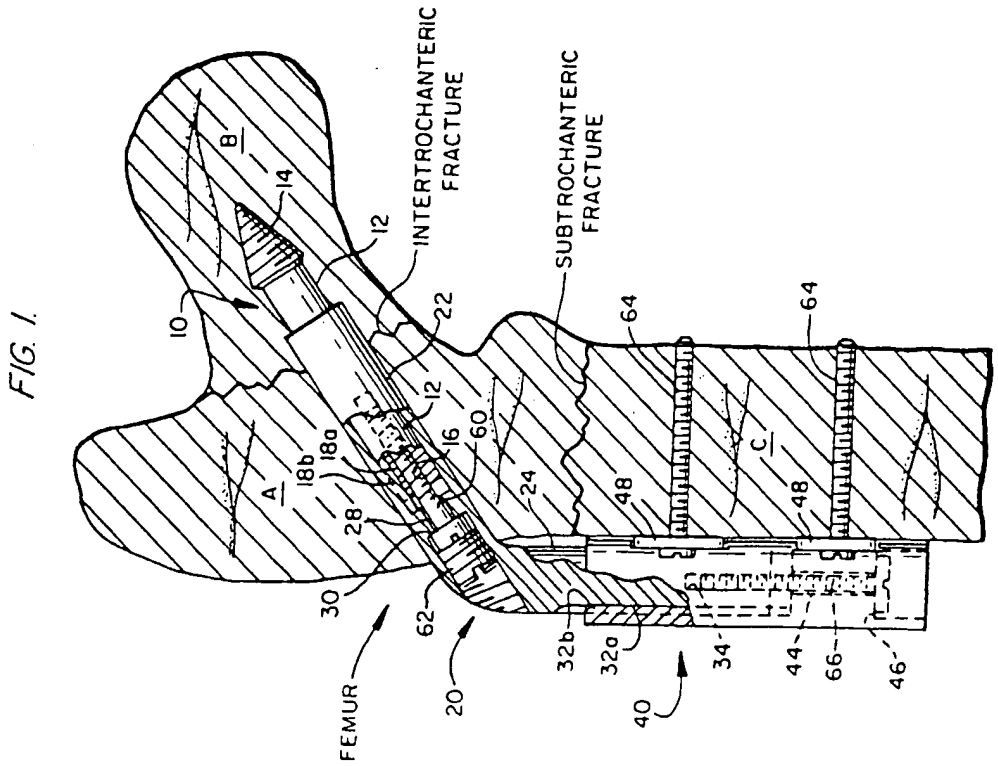

14
42
16
10
18a
26
22
18b
28
24
30
20
60
62
32a
32b
42
50
48
40
64
44
46
66

FIG. 1.


INTERTROCHANTERIC FRACTURE
SUBTROCHANTERIC FRACTURE
B
A
C
14
12
10
22
16
60
18a
18b
28
30
62
24
48
64
FEMUR
20
32b
32a
40
34
44
66
46